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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/864,590	05/24/2001	Harry Stefan Barowski	DE900006US1	2120

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EXAMINER	
GERSTL, SHANE F	
ART UNIT	PAPER NUMBER
2183	

DATE MAILED: 10/19/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/864,590	BAROWSKI ET AL.	
	Examiner	Art Unit	
	Shane F Gerstl	2183	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 August 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *11-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *11-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *5/24/01* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 11-20 have been examined.

Papers Received

2. Receipt is acknowledged of amendment papers where the papers have been placed of record in the file.

3. The 35 USC 112 rejections and objections to the claims, drawings, and specification have been overcome by the amendment and are herein withdrawn. Please note a new 112 rejection exists as set forth below and a claim objection to claim 20 that corresponds to the previous claim objection of claim 10 and was not addressed by Applicant is also set forth below.

4. The effort put forth by Applicant to correct minor informalities throughout the specification is noted and appreciated.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 11-15 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The term "essentially equal" in claims 11 and 14 is a relative term which renders the claim indefinite. The term "essentially equal" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one

of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

Claim Objections

7. Claim 20 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. The only possible limitation of the claim is that the microprocessor's environment would be limited by placing it in a computer system. The claim would be further limiting if a microprocessor could exist outside of a computer system as well as within one. However, since a microprocessor device is a computer system, a microprocessor cannot exist outside of a computer system and therefore, it cannot be further limiting in this manner.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 11-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang (Highly Accurate Data Value Prediction using Hybrid Predictors) in view of Nakra (Global Context-Based Value Prediction).

10. In response to claim 11,

a. Wang discloses a hybrid prediction method usable in parallel computing processors for predicting a value to be produced by an anticipated execution of an instruction comprising:

i. Storing, in a first table, a current actual value resulting from a most-recent execution of the instruction, a current history value determined from the current actual value and a previous actual value produced by a prior execution of the instruction, and a value history pattern for the instruction, the stride history pattern representing a pattern of strides resulting from prior executions of the instruction, wherein history values, including the current history value, of the pattern of history values are stored in a history field of the first table; [In figure 4, the VHT has actual data values and value history patterns. Section 3.3 shows that these data values are the values of the most recent executions including the most recent execution or current value and that the value history pattern results from prior executions.]

ii. Selecting a history value from a history field of the first table (figure 4, output to PHT);

iii. And computing a predicted value for the history value to be produced by the anticipated execution of the instruction, the computing using the value from the selecting and the current actual value, wherein the predicted value from the computing is essentially equal to a prediction result from one of a last value prediction, a stride-based value prediction,

and a stride-history-pattern-based value prediction (figure 4, predicted value).

Basically, the first table of figure 6 directly corresponds to the claim except that instead of stride history, value history is used and instead of data values, stride values are used.

b. Wang does not explicitly disclose

iv. the first table storing a current stride determined from the current actual value and a previous actual value produced by a prior execution of the instruction, and a stride history pattern for the instruction, the stride history pattern representing a pattern of strides resulting from prior executions of the instruction, wherein strides, including the current stride, of the pattern of strides are stored in a stride field of the first table;

v. Selecting a stride from the stride field of the first table;

vi. And computing a predicted value for the value to be produced by the anticipated execution of the instruction, the computing using the stride from the selecting and the current actual value, wherein the predicted value form the computing is essentially equal to a prediction result from one of a last value prediction, a stride-based value prediction, and a stride-history-pattern-based value prediction.

c. Nakra has taught in figure 7 the storage of a plurality of stride fields (stride 1 and stride 2) in a table. The paragraph under figure 6 shows that the first stride is the difference between the last two values of an instruction and that the

second stride is updated when the first stride occurs twice in a row and thus there are two previous strides. The figure also shows the use of the last value from execution or current actual value to make the prediction with a stride.

d. Nakra has taught in the last paragraph of the first page that stride prediction has been shown to improve prediction performance significantly over last value prediction. Last value prediction is the scheme used with the two-table method given by Wang in figure 7 as the data values store the last four result values. This performance improvement would have motivated one of ordinary skill in the art to modify the design given in section 3.3 of Wang to use a plurality of stride fields holding past strides and a stride history pattern field rather than last value fields. With these multiple strides incorporated into the design of section 3.3 of Wang, a stride history pattern field and past strides for these in order to take advantage of pattern-based prediction as shown to be an objective in the abstract of Wang. As required by Nakra, the new design would require a field for the last or current value so as to calculate the predicted value. Further the design would logically keep track of a stride pattern history in the pattern history table rather than a value pattern history.

It would have been obvious to one of ordinary skill in the art at the time of invention to modify the design of Wang to incorporate multiple strides rather than multiple last values as taught by Nakra for the two-level history pattern prediction taught by Wang so that significant performance improvements would have been realized.

11. In regard to claim 12, Wang in view of Nakra discloses the method according to claim 11, wherein the method further comprises:

a. Calculating the current stride as a difference between the current actual value and another actual value resulting from an execution of the instruction prior to the most-recent execution of the instruction; [Column one of page 285 of Wang shows that the stride is calculated by comparing (subtracting) the last result (D1) and an earlier completed instance (stored in value).]

b. And updating at least one counter of a plurality of saturating counters in a stride pattern history table according to the current stride, the plurality of saturating counters being associated with the stride history pattern. [The second column of page 285 and the top of page 286 show that the count in a pattern history (tracking) table has four counters that are updated according to the current value. It is also shown here that the counters saturate and are thus saturating counters. As shown above, the stride is calculated from a compare of an earlier instruction and the last result and figure 7 shows that a predicted data value is derived from the stride field holding this information. Since the value pattern history table is now the stride pattern history table, the construct remains the same but for strides rather than values.]

12. In regard to claim 13, Wang in view of Nakra discloses the method according to claim 12, wherein:

a. The stride from the selecting corresponds to a counter having a count exceeding a threshold, the counter being one of the plurality of saturating

counters in the stride pattern history table; [The top paragraph of column 2 of page 288 shows that a prediction is made when the value in an entry of the pattern history table (counter) is above a certain threshold.]

b. And the computing further comprises adding the current actual value and the stride from the selecting. [As discussed previously and as originally taught by Nakra in figure 7.]

13. In regard to claim 14, Wang discloses the method according to claim 11,

a. if an entry for the instruction from the storing is not found in the first table, initializing a plurality of saturating counters in a stride pattern history table associated with the instruction such that the predicted value from the computing is essentially equal to the prediction result obtained from the last value prediction for a period before a comparison of the saturating counters to a threshold indicates detection of the stride history pattern; [When there is no entry in the table for an instruction, the counters must inherently be initialized. The end of section 3.3 of Nakra indicates that the history is updated by shifting in the most recent or last value and the counters are updated in accordance to the history pattern as shown in figure 4. Thus the history to this point would only consist of the last value and the prediction would be essentially equal to it.]

b. wherein the method further comprises: updating at least one of the plurality of saturating counters upon a subsequent occurrence of the stride history pattern resulting from one or more subsequent executions of the instruction. [Section shows that the counters are updated on subsequent

occurrences of the history pattern, which is a result of subsequent executions of the instruction.]

14. In regard to claim 15, Wang discloses the method according to claim 12, wherein the updating further comprises:

a. Incrementing a counter of the plurality of saturating counters in the stride pattern history table, wherein the counter is associated with the current stride; [As discussed previously]

b. Decrementing at least one other counter of the plurality of saturating counters in the stride pattern history table, wherein the at least one other counter is associate with another of the strides stored in the stride field; [The top of page 286 in Nakra shows that the other counters of other strides are decremented.]

c. And wherein the stride from the selecting corresponds to one of the plurality of saturating counters having a greatest count if the greatest count exceeds a threshold, and signaling to indicate that the value to be produced by the anticipated execution of the instruction cannot be predicted if none of the plurality of saturating counters has a count exceeding the threshold. [As shown in the last paragraph of page 285, the value that exceeds the threshold (the greatest value) is selected. The section also shows that no prediction is made if the counts are less than the threshold.]

15. In regard to claim 16, since the limitations are similar to claim 11, the argument applied to claims 11-15 are valid for claim 16. The additional limitation of the pattern history table being addressable by a two table lookup mechanism using the stride

history pattern field of the first table is easily seen in figure 4 of Nakra where the value history pattern field is the stride history pattern field after modification as discussed above.

16. In regard to claim 17, Wang in view of Nakra discloses the hybrid prediction system according to claim 16 wherein the plurality of stride fields comprises a number of strides in a range, the range being greater than 3 and less than 7. [Wang has shown in figure 4 that the number of fields (data values modified to strides) that are used to populate the history pattern (as discussed above) is 4. As shown above, these fields have been shown to be stride fields with the obvious modification.]

17. In regard to claim 18, Wang in view of Nakra discloses a sub-unit for use in microprocessor devices having at least one prediction system according to claim 17. [Section 1 shows that value prediction is used for exploiting instruction-level parallel processing and thus the system of figure 6 is a sub-unit for use in a processor or microprocessor.]

18. In regard to claim 19, Wang in view of Nakra discloses a microprocessor device having at least one sub-unit according to claim 18. [As shown above, the sub-unit is for use in a microprocessor and so it is in the processor.]

19. In regard to claim 20, Wang in view of Nakra discloses a computer system having a microprocessor device according to claim 19. [Since the microprocessor is a computer system, this claim is also met with the above argument.]

Response to Arguments

20. Applicant's arguments filed 8/6/04 have been fully considered but they are not persuasive.

21. Applicant has argued that the proposed modification in the previous Action would be inoperable to produce a predicted value to be produced by an anticipated execution of an instruction in accordance with the last value prediction, stride based value prediction or stride-history-pattern-based prediction due to an adding of stride fields. In order to simplify the situation and avoid confusion, the Examiner has used figure 4 rather than figure 6 to show that this add the Applicant is concerned with will not take place. Rather, an addition takes place between the selected stride and the current value as taught by Nakra.

22. Applicant also argues that Nakra actually teaches away from the proposed modification since Nakra states that hybrid predictors do not have efficient implementations due to their complexities and that Nakra specifically cites the hybrid predictor described in Wang. Applicant asserts that when Nakra is referring to Wang as being complex that Nakra actually states reference to the proposed hybrid design of Wang (column 1, page 2). This proposed design would be of figure 6 and the proposed modification is using the simpler design of figure 4. The design of figure 4 had already been established by the time Wang introduced his proposed hybrid predictor.

Conclusion

23. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

24. The following is text cited from 37 CFR 1.111(c): In amending in reply to a rejection of claims in an application or patent under reexamination, the applicant or patent owner must clearly point out the patentable novelty which he or she thinks the claims present in view of the state of the art disclosed by the references cited or the objections made. The applicant or patent owner must also show how the amendments avoid such references or objections.

25. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The previously cited references remain pertinent and are cited herein as well.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shane F Gerstl whose telephone number is (571) 272-4166. The examiner can normally be reached on M-F 6:45-4:15 (First Friday Off).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Chan can be reached on (571) 272-4162. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Shane F Gerstl
Examiner
Art Unit 2183

SFG
October 18, 2004

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